REMARKS

In response to the Office Action mailed June 18, 2003 and in consideration of the following remarks, Applicants respectfully request reconsideration of the above-captioned application. Claims 13-26 and 32 have been withdrawn. Claims 8-12 and 27 are presently Cancelled. Accordingly, Claims 1-7 and 28-31 are currently pending.

Discussion of Drawing Amendments

In paragraph 2 of the Office Action the Examiner states that the drawings are objected to as failing to comply with 37 C.F.R. §1.84(p)(5) because reference labels 80 and 84 (Figures 3A and 3B) are not mentioned in the description. Accordingly, Applicants have amended the specification to include reference labels 80 and 84. Applicants submit that the addition of the reference labels 80 and 84 in the specification does not add new matter, but merely clarifies the reference labels used in the figures. Applicants respectfully request removal of this objection.

Discussion of Claim Rejections Under 35 U.S.C. § 102

In paragraphs 4-10 of the Office Action, the Examiner indicated that each of the independent Claims 1, 7, 8, 12, 27, 28, and 30 was rejected by one or more references under 35 U.S.C. §102(b) and/or §102(e). In particular, Claims 1, 7, 8, and 27 were each rejected under 35 U.S.C. §102(b) in view of Bowman (U.S. Patent No. 5,044,943), Mizuno (U.S. Patent No. 5,534,072), and Moore (U.S. Patent No. 5,820,686) and were additionally rejected under 35 U.S.C. §102(e) in view of Wang (U.S. Patent No. 6,167,834), Ohmi (U.S. Patent No. 6,423,178), Ho (U.S. Patent No. 6,500,266) and Kholodenko (U.S. Patent No. 6,503,368). Claim 12 was rejected under 35 U.S.C. §102(e) in view of Wang and Claims 28 and 30 were rejected under 35 U.S.C. §102(e) in view of Ho. In view of the above claims amendments and the following remarks applicants respectfully request reconsideration.

Each of the pending independent Claims 1, 7, 28, and 30 has been amended to clarify that the claimed oxidation system is specifically a VCSEL oxidation system, where a semiconductor layer of a VCSEL is selectively oxidized to form a current confinement layer. For example, Claim 1, as amended, recites "[a] VCSEL oxidation system comprising a stage having a surface and a VCSEL supported on said stage." None of the above-cited references (including Bowman,

Mizuno, Moore, Wang, Ohmi, Ho, and Kholodenko) teaches or fairly suggests the oxidation of a VCSEL.

In paragraph 11 of the Office Action, the Examiner noted that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. Accordingly, Applicants have further amended Claims 1, 7, 28, and 30 to positively recite a VCSEL as a element of the apparatus claims. For example, Claim 7, as amended, recites "a wafer stage having a top surface ... [and] a VCSEL supported by said top surface of said wafer stage." None of the above-cited references (including Bowman, Mizuno, Moore, Wang, Ohmi, Ho, and Kholodenko) teaches or fairly suggests "a VCSEL supported by said top surface of said wafer stage," as recited in Claim 7. Accordingly, Claim 7 is believed to be in condition for allowance over the cited art. Each of Claims 1, 28, and 30 recites features similar to the above-discussed features of Claim 7. Thus, withdrawal of the §102 rejections is requested.

Discussion of Claim Rejections Under 35 U.S.C. § 103

In paragraphs 13-15 of the Office Action, the Examiner indicated that each of the independent Claims 1, 7, 8, 12, 27, 28, and 30 was rejected by one or more references under 35 U.S.C. §103. In particular, Claims 1, 7, 8, 12, 28, and 30 were each rejected under 35 U.S.C. §102(b) as being unpatentable over Masakazu Arai (AlAs Oxidation System with H2o for Oxide-Confined Surface Emitting Lasers) in view of Kholodenko. Additionally, Claims 1, 7, 8, 12, and 27 were each rejected under 35 U.S.C. §103 as being unpatentable over Arai in view of each of Moore and Mizuno. In view of the above claim amendments and the following remarks applicants respectfully request reconsideration.

According to M.P.E.P.§716.02 (c), evidence of unexpected results must be weighed against evidence supporting prima facie obviousness in making a final determination of the obviousness of the claimed invention. For example, In re May (574 F.2d 1082 (CCPA 1978)) discusses the rejection of claims that were "directed to a method of effecting analgesia without producing physical dependence by administering the levo isomer of a compound having a certain chemical structure." The court, in weighing the evidence of unexpected results, realized that "although the compound had the expected result of potent analgesia, there was evidence of record showing that the goal of research in this area was to produce an analgesic compound

which was nonaddictive." Accordingly, the court held that "[e]vidence that the compound was unexpectedly nonaddictive was sufficient to overcome the obviousness rejection."

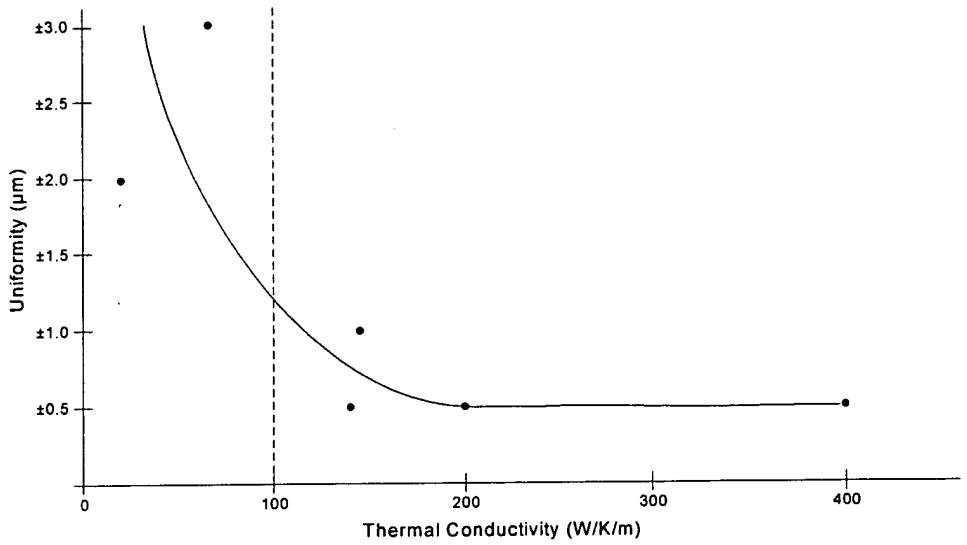
Prior to filing of the present application, the stage of a VCSEL oxidation chamber typically comprised one or more of many different materials. One of skill in the art would not have expected any difference in uniformity of an oxidized area of an Aluminum containing layer of a VCSEL based on the type of material used for the stage. More particularly, prior to the filing date of the present application, the use of a stage having a high thermal conductivity was not associated with the uniform oxidation of a current confinement layer in a VCSEL. Applicants, however, have discovered the unexpected result of an increased uniformity of the oxidized area when the stage comprises a material having a thermal conductivity of greater than 100 W/K/m. Accordingly, Applicants asserts that the evidence of unexpected results is sufficient to overcome the present obviousness rejections.

Applicants performed experiments using stages comprising different materials and determined a surprising relationship between the stage material and the uniformity of an oxidized area around the perimeter of an current confinement layer. In particular, Table 1 of the specification, reproduced below, illustrates the uniformity of an oxidized area where a VCSEL was placed on a stage of various materials for current confinement layer oxidizing.

Table 1

Material of Disk	Uniformity	Thermal Conductivity of Disk
Silicon	±1.0 μm	145 W/K/m
PBN	±3.0 μm	65 W/K/m
Graphite	±0.5 μm	140 W/K/m
Stainless Steel	±2.0 μm	20 W/K/m
Copper	±0.5 μm	400 W/K/m
Silicon Carbide	±0.5 μm	200 W/K/m
Sapphire	±1.5 μm	45 W/K/m

A line graph, plotting the uniformity measurements shown above in Table 1, is also provided to further illustrate the surprising relationship between the thermal conductivity of a stage and the uniformity of an oxidized area around the perimeter of an current confinement layer.



As illustrated by the graph, there is a surprising difference in uniformity when the thermal conductivity of the stage is greater than 100. More particularly, the variance in width of the oxidized area 88 extending along the cleaved surface 90 (Figure 3B) of the VCSEL is significantly decreased when the stage, or a disk resting on the stage, is made of a material having a thermal conductivity of greater than 100 W/K/m. In fact, the oxidized portion of a formed current confinement layer is 2 – 6 times more uniform when a stage having a thermal conductivity of more than 100 W/K/m supports the semiconductor device. With reference to the materials listed in Table 1, the three materials having a thermal conductivity of less than 100 W/K/m have a uniformity of ±3.0 µm, ±2.0 µm, and ±1.5 µm, while three of the materials having a thermal conductivity of greater than 100 W/K/m each have a uniformity of ± 0.5 µm and a fourth material having a thermal conductivity of greater than 100 W/K/m has a uniformity of ±1.0 µm. Accordingly, the results displayed in Table 1 indicate that the thermal conductivity of a stage material which supports a VCSEL during oxidation correlates with the uniformity of an oxidized area of the VCSEL. This relationship had not been recognized in the prior art.

Claim 1, recites "[a] VCSEL oxidation system comprising ... a material mounted on said stage, wherein said material has a thermal conductivity of at least about 100 watts/K/meter." However, none of the cited references (including Masakazu Arai, Kholodenko, Moore, and Mizunoz) recognized the unexpected relationship between the composition of the stage and the

uniformity of an oxidized portion of a VCSEL current confinement layer. Thus, Applicants believe that Claim 1 is in condition for allowance over the cited art. Each of the independent Claims 7, 28, and 30 recite features similar to the above-discussed feature of Claim 1. Accordingly, Applicants respectfully request withdrawal of the §103 rejections.

CONCLUSION

Applicants have endeavored to address all of the Examiner's concerns as expressed in the outstanding Office Action. Accordingly, comments in support of the patentability of the pending claim set are presented above. In light of the above remarks, reconsideration and withdrawal of the outstanding rejections is specifically requested. If the Examiner finds any remaining impediment to the prompt allowance of these claims that could be clarified with a telephone conference, the Examiner is respectfully requested to initiate the same with the undersigned.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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